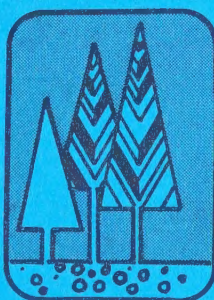




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FLOOD CONTROL AND DRAINAGE STUDY

Interim Report



**RESOURCE
ECONOMICS
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ALBERTA DEPARTMENT OF AGRICULTURE



ECONOMICS DIVISION

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FLOOD CONTROL AND DRAINAGE STUDY

Interim Report

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Economics Division

March, 1972

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TABLE OF CONTENTS

	<u>Page</u>
Table of Contents	i
List of Tables	ii
Introduction and Purpose	1
Methodology	2
Results	4
Conclusion and Implications	21

LIST OF TABLES

		<u>Page</u>
TABLE I	Types of Water Resource Projects Constructed, 1966-1971	3
TABLE II	Origin of Water Resource Projects, 1966-1971	3
TABLE III	Year Project/Study Initiated	4
TABLE IV	Completed Water Resource Projects - Edmonton Region, 1966-1971	4
TABLE V	Capital Project Costs	5
TABLE VI	Province's Share of Capital Project Costs	5
TABLE VII	Waterfowl Habitat Evaluations	7
TABLE VIII	Recreation Capabilities of Lands Involving Flood Control and Drainage Works	7
TABLE IX	Agricultural Capability of Lands Supporting Flood Control and Drainage Works	8
TABLE X	Type of Project vs. Cost of Project	9
TABLE XI	Number of Acres to Benefit vs. Cost of Project	10
TABLE XII	Value of Waterfowl Habitat Destroyed vs. Number of Acres to Benefit	11
TABLE XIII	Recreational Capability vs. Number of Acres to Benefit	12
TABLE XIV	Agricultural Capability vs. Number of Acres to Benefit	12
TABLE XV	Local Government vs. Cost of the Project	13
TABLE XVI	Local Government vs. Provincial Government Share of Cost	14
TABLE XVII	Local Government vs. Type of Project	15
TABLE XVIII	Number of Acres to Benefit vs. Type of Project	16
TABLE XIX	Quality of Waterfowl Habitat vs. Type of Project	16
TABLE XX	Local Government vs. Project Cost Per Acre	17
TABLE XXI	Local Government vs. Provincial Share of Cost per Acre	18

INTRODUCTION AND PURPOSE

This study was initiated as a joint project involving this Branch and the Demand and Evaluation Section of the Water Resources Division of the Department of the Environment. The primary purpose was to set up an on-going data collection system of information with regard to flood control and drainage projects undertaken by the Water Resources Division. Flood control works are designed to deal with the situation where water from a water course is overflowing its banks. Drainage, on the other hand, constitutes works intended to remove incidental water which accumulates on land and results in temporary ponding.

There is a certain administrative procedure which must be followed before corrective works are constructed. A complaint or request must first be made known to the Water Resources Division. An inspection is then made of the complaint and a recommendation made with regard to further action; either that an engineering survey be conducted or that no further action is necessary. The engineering survey proposes structures and gives a cost estimate. If these plans are accepted the project is constructed subject to certain cost sharing arrangements.

Out of this study, it was expected that an evaluation of the projects would evolve in terms of the effect they have had on the farming activities of those concerned. That is, if works were designed to drain a certain low area, has in fact this area been put to more productive use, or were the works constructed in vain. Changing land values as a result of the project was also to be a consideration.

METHODOLOGY

A sample of completed Water Resource projects was chosen in order to derive a model. The sample chosen consisted of those projects completed since 1966 in the Edmonton region since data on these projects was already summarized. Each of these projects was then summarized for the following information:

1. Location - legal land description.
2. Local government.
3. The type of project.
4. Who initiated the request.
5. The year the project or study was initiated.
6. The year the report was completed.
7. The year construction was completed.
8. The total cost of the project.
9. The provincial share of the cost.
10. Other agencies involved in the project, i.e. Ducks Unlimited, etc.
11. Other agencies share of the cost (%).
12. The number of acres of agricultural land that is benefited.
13. The importance of wildlife habitat.
14. The recreational capability of the land.
15. The agricultural capability of the land.

In order to obtain information with regard to the wildlife, recreational and agricultural characteristics of the land, each project was sketched on a plastic overlay. This overlay was then superimposed on each respective base map, and a judgement made with respect to the project's effect on each land use. Personnel

with the Canadian Wildlife Service determined the effect that each project had on the waterfowl habitat that it disturbed.

RESULTS

The following are some preliminary results of this study.

Fifty-eight projects completed since 1966 in the Edmonton region were analyzed. In some cases however, it is not possible to extract information on each variable. As a result, the number of responses in some instances will be less than 58. Table I shows the types of projects constructed as well as how many of each.

TABLE I
TYPES OF WATER RESOURCE PROJECTS CONSTRUCTED
Edmonton Region - 1966-1971

<u>Type of Project</u>	<u>Number</u>	<u>% of Total</u>
Flood Control	37	63.8
Drainage	1	1.7
Flood Control and Drainage	11	19.0
Erosion Control	2	3.4
Stabilization	1	1.7
Conservation	1	1.7
Irrigation	4	6.9
Recreation	<u>1</u>	<u>1.7</u>
TOTAL	58	100.0

The request that a survey of a particular water problem be made may originate from a number of sources. Table II lists these sources and the number of projects completed that were requested by these sources.

TABLE II
ORIGIN OF WATER RESOURCE PROJECTS
Edmonton Region - 1966-1971

<u>Initiated by</u>	<u>Number</u>	<u>% of Total</u>
Town, etc.	9	16.7
Municipality, County	14	25.9
Individual Landowner	14	25.9
Petition of Local Landowners	12	22.2
Fish and Game Association	3	5.6
Drainage District	1	1.9
Other	<u>1</u>	<u>1.9</u>
TOTAL	54	100.0

Although this study concerns itself with those projects completed in the period 1966-1971, the request for a survey of the problem could have been brought forward much earlier. Table III shows the years that some of the projects were initiated as well as the number of projects initiated during those years.

TABLE III
YEAR PROJECT/STUDY INITIATED

<u>Year</u>	<u>Number</u>	<u>% of Total</u>
1900 - 1950	7	14
1951 - 1960	5	10
1961 - 1970	<u>37</u>	<u>76</u>
TOTAL	49	100

Table IV shows for each year in the period 1966-1971 the number of Water Resource Division flood control and related projects completed in the Edmonton region.

TABLE IV
COMPLETED WATER RESOURCE PROJECTS
Edmonton Region - 1966-1971

<u>Year</u>	<u>Number</u>	<u>% of Total</u>
1966	3	5
1967	11	20
1968	19	34
1969	14	25
1970	7	13
1971	<u>2</u>	<u>3</u>
TOTAL	56	100

The total capital cost of the projects under study covers a wide range of values. Table V shows this information.

TABLE V
CAPITAL PROJECT COSTS

<u>Cost of Projects - \$</u>	<u>Number of Projects</u>	<u>% of Total</u>
0 - 5,000	8	14
5,001 - 10,000	14	25
10,001 - 50,000	28	50
50,001 - 100,000	4	7
More than 100,000	<u>2</u>	<u>4</u>
TOTAL	56	100

The total amount of capital expenditures on flood control and related schemes in the Edmonton region during the period 1966-1971 was about \$1,614,800.

The provincial government's share of the capital costs also varied widely. These variations are due to the cost of the project and the cost sharing arrangement at the time. Table VI shows the provincial government's share of the construction costs.

TABLE VI
PROVINCE'S SHARE OF CAPITAL PROJECT COSTS

<u>Share (Dollars)</u>	<u>Number of Projects</u>	<u>% of Total</u>
0 - 5,000	15	27
5,001 - 10,000	18	33
10,001 - 50,000	21	38
50,001 - 100,000	--	--
More than 100,000	<u>1</u>	<u>2</u>
TOTAL	55	100

The province's share of the capital expenditures on flood control and related works amounted to about \$854,000 in the Edmonton region during the period 1966-1971. This represents some 53% of the capital cost of all such works in the Edmonton region during that period.

Agencies other than provincial and municipal governments were involved in five projects during the study period. Ducks Unlimited were involved in three and the P.F.R.A. and the Ponoka Fish and Game Association were each involved in one project.

The projects included in this study varied also in terms of the number of acres of agricultural land that should benefit from each project. Reports showed benefit to agricultural land in 46 projects. The total number of acres to benefit in this project is about 38,000 acres. The total capital cost amounts to about \$31/acre while the provincial share of this amount is approximately \$18/acre.

Each project, where possible, was analyzed as to its effect on wildlife habitat. The point where the disturbance took place was evaluated in light of its importance to the surrounding area. That is, if a slough were drained, and in the same proximity other sloughs existed, the loss of that water body would not be as noticeable as if no other sloughs were present in the surrounding area. The code used in these evaluations was from 1 to 5 where 1 represents a situation where the project has a potentially dramatic detrimental effect on waterfowl habitat and 5 represents no noticeable effect or even a benefit to waterfowl habitat. Between 1 and 5 are varying degrees of influence. This evaluation is summarized in Table VII.

TABLE VII
WATERFOWL HABITAT EVALUATIONS

<u>Code</u>	<u>Number of Projects</u>	<u>% of Total</u>
1	8	16
2	5	10
3	6	12
4	12	24
5	<u>19</u>	<u>38</u>
TOTAL	50	100

As far as the recreational capability of lands disturbed by flood control and drainage projects is concerned, little real damage has resulted. According to this study, only lands with recreation capabilities of 5, 6 and 7 are involved. This information is shown in Table VIII.

TABLE VIII
RECREATION CAPABILITIES OF LANDS INVOLVING
FLOOD CONTROL AND DRAINAGE WORKS

<u>Recreational Capability</u>	<u>Number of Projects</u>	<u>% of Total</u>
5	16	35
6	27	59
7	<u>3</u>	<u>6</u>
TOTAL	46	100

The agricultural capability of lands supporting these projects ranged from number 1 soils to organic soils. These results are depicted in Table IX.

TABLE IX
AGRICULTURAL CAPABILITY OF LANDS SUPPORTING
FLOOD CONTROL AND DRAINAGE WORKS

<u>Agricultural Capability</u>	<u>Number of Projects</u>	<u>% of Total</u>
1	1	3
2	3	11
3	7	25
4	3	11
5	4	14
6	2	7
7	-	-
Organic Soils	<u>8</u>	<u>29</u>
TOTAL	28	100

The following tables show certain relationships between some of the variables. In each case the number appearing in each "box" represents the number of projects that have the characteristics of the vertical and horizontal axes at that point.

TABLE X

TYPE OF PROJECT VS. COST OF PROJECT

Cost of Project (\$)	Type of Project	Flood Control	Drainage	Flood Control and Drainage	Erosion Control	Lake Stabilization	Conservation	Backflood Irrigation	Recreation	Total
0 - 5,000		6	-	2	-	-	-	-	-	8
5,001 - 10,000		10	-	2	1	-	-	1	-	14
10,001 - 50,000		17	1	6	1	-	1	1	1	28
50,001 - 100,000		4	-	-	-	-	-	-	-	4
More than 100,000		-	-	1	-	1	-	-	-	2
TOTAL		37	1	11	2	1	1	2	1	56

TABLE XI
NUMBER OF ACRES TO BENEFIT VS. COST OF PROJECT

Cost of Project (\$)	No. of Acres to Benefit (Acres)	0 - 100	101 - 500	501 - 1,000	1,001 - 2,000	2,001 - 5,000	More than 5,000	Total
0 - 5,000		3	3	-	-	-	-	6
5,001 - 10,000		0	6	1	1	-	-	8
10,001 - 50,000		0	4	7	7	2	-	20
50,001 - 100,000		-	-	2	2	-	-	4
More than 100,000		-	-	-	-	-	1	1
TOTAL		3	13	10	10	2	1	39

TABLE XII
QUALITY OF WATERFOWL HABITAT DESTROYED VS. NUMBER OF ACRES TO BENEFIT

No. of Acres to Benefit (Acres)	1	2	3	4	5	Total
0 - 100	1	1	-	1	-	3
101 - 500	2	2	2	3	3	12
501 - 1,000	2	-	3	2	3	10
1,001 - 2,000	2	1	-	2	4	9
2,001 - 5,000	-	-	-	1	1	2
More than 5,000	-	-	-	-	1	1
TOTAL	7	4	5	9	12	37

TABLE XIII

RECREATIONAL CAPABILITY VS. NUMBER OF ACRES TO BENEFIT

No. of Acres to Benefit \ Recreational Capability (Acres)	5	6	7	Total
0 - 100	2	1	-	3
101 - 500	2	9	1	12
501 - 1,000	5	5	-	10
1,001 - 2,000	3	4	1	8
2,001 - 5,000	-	1	1	2
More than 5,000	1	-	-	1
TOTAL	13	20	3	36

TABLE XIV

AGRICULTURAL CAPABILITY VS. NUMBER OF ACRES TO BENEFIT

No. of Acres to Benefit \ Agricultural Capability (Acres)	1	2	3	4	5	6	7	Organic	Total
0 - 100	-	-	1	-	1	-	-	-	2
101 - 500	-	2	2	1	-	1	-	2	8
501 - 1,000	-	-	1	1	1	-	-	1	4
1,001 - 2,000	-	-	1	1	-	1	-	3	6
2,001 - 5,000	-	-	1	-	-	-	-	1	2
More than 5,000	-	-	-	-	1	-	-	-	1
TOTAL	-	2	6	3	3	2	-	7	23

TABLE XV

LOCAL GOVERNMENT VS. COST OF THE PROJECT

Local Government \ Cost of the Project (\$)		0 - 5,000	5,001 - 10,000	10,001 - 50,000	50,001 - 100,000	More than 100,000	Total
County	3	1	-	1	-	-	2
	9	-	1	3	-	-	4
	10	-	-	1	1	-	2
	11	-	2	8	-	1	11
	12	-	-	-	1	-	1
	17	-	-	1	-	-	1
	19	-	1	-	-	-	1
	20	-	-	-	1	-	1
	22	1	-	-	-	-	1
	23	1	-	1	-	-	2
	24	-	1	-	-	-	1
	25	-	1	1	-	-	2
	28	-	-	1	-	-	1
	30	2	-	-	-	-	2
	31	1	1	-	-	-	2
M.D.	52	-	1	-	-	-	1
	61	1	-	-	-	1	2
	84	-	-	1	-	-	1
	87	1	4	2	1	-	8
	90	-	-	3	-	-	3
	92	-	2	4	-	-	6
I.D.	18	-	-	1	-	-	1
TOTAL		8	14	28	4	2	56

TABLE XVI

LOCAL GOVERNMENT VS. PROVINCIAL GOVERNMENT SHARE OF COST

Local Government \ Provincial Share (\$)		0-5,000	5,001-10,000	10,001-50,000	50,001-100,000	More than 100,000	Total
County	3	1	-	1	-	-	2
	9	-	2	2	-	-	4
	10	-	-	2	-	-	2
	11	1	6	5	-	-	12
	12	-	-	1	-	-	1
	17	-	-	1	-	-	1
	19	1	-	-	-	-	1
	20	-	-	1	-	-	1
	22	1	-	-	-	-	1
	23	1	-	1	-	-	2
	24	-	1	-	-	-	1
	25	-	2	-	-	-	2
	28	-	-	-	-	-	-
	30	2	-	-	-	-	2
	31	1	-	-	-	-	1
M.D.	52	-	1	-	-	-	1
	61	1	-	-	-	1	2
	84	-	-	1	-	-	1
	87	4	2	2	-	-	8
	90	-	2	1	-	-	3
	92	2	2	2	-	-	6
I.D.	18	-	-	1	-	-	1
TOTAL		15	18	21	-	1	55

TABLE XVII

LOCAL GOVERNMENT VS. TYPE OF PROJECT

Type of Local Project Government	Flood Control	Drainage	Flood Control and Drainage	Erosion Control	Lake Stabilization	Conservation	Backflood Irrigation	Recreation	Total
County 3	1	-	-	-	-	-	-	1	2
9	4	-	-	-	-	-	-	-	4
10	1	-	-	1	-	-	-	-	2
11	4	-	6	-	1	-	2	-	13
12	1	-	-	-	-	-	-	-	1
17	-	-	-	-	-	1	-	-	1
19	1	-	-	-	-	-	-	-	1
20	1	-	-	-	-	-	-	-	1
22	1	-	-	-	-	-	-	-	1
23	2	-	-	-	-	-	-	-	2
24	1	-	-	-	-	-	-	-	1
25	1	-	-	1	-	-	-	-	2
28	-	-	-	-	-	-	1	-	1
30	-	-	2	-	-	-	-	-	2
31	2	-	-	-	-	-	-	-	2
52	-	-	-	-	-	-	1	-	1
61	1	-	1	-	-	-	-	-	2
84	-	1	-	-	-	-	-	-	1
87	8	-	-	-	-	-	-	-	8
90	3	-	-	-	-	-	-	-	3
92	4	-	2	-	-	-	-	-	6
18	1	-	-	-	-	-	-	-	1
TOTAL	37	1	11	2	1	1	4	1	58

TABLE XVIII

NUMBER OF ACRES TO BENEFIT VS. TYPE OF PROJECT

Type of Project No. of Acres to Benefit (acres)	Flood Control	Drainage	Flood Control and Drainage	Erosion Control	Lake Stabilization	Conservation	Backflood Irrigation	Recreation	Total
0-100	3	-	-	-	-	-	-	-	3
101-500	8	-	4	1	-	-	1	-	14
501-1,000	8	1	1	-	-	-	-	-	10
1,001-2,000	7	-	3	-	-	-	-	-	10
2,001-5,000	-	-	2	-	-	-	-	-	2
More than 5,000	-	-	1	-	-	-	-	-	1
TOTAL	26	1	11	1	-	-	1	-	40

TABLE XIX

QUALITY OF WATERFOWL HABITAT VS. TYPE OF PROJECT

Type of Project Quality of Waterfowl Habitat	Flood Control	Drainage	Flood Control and Drainage	Erosion Control	Lake Stabilization	Conservation	Backflood Irrigation	Recreation	Total
1	7	-	1	-	-	-	-	-	8
2	5	-	-	-	-	-	-	-	5
3	3	1	1	-	1	-	-	-	6
4	7	-	3	1	-	-	1	-	12
5	10	-	5	1	-	1	2	1	20
TOTAL	32	1	10	2	1	1	3	1	51

TABLE XX

LOCAL GOVERNMENT VS. PROJECT COST PER ACRE

Cost per Acre \$		Less than 10	10-20	21-30	31-40	41-50	51-60	Over 60	Total
Local Government									
County	3	-	-	-	1	-	-	-	1
	9	-	-	1	-	-	2	-	3
	10	-	-	-	-	-	1	-	1
	11	1	6	1	1	-	1	-	10
	12	-	-	-	-	-	1	-	1
	20	-	-	-	-	-	-	1	1
	22	-	-	-	1	-	-	-	1
	23	-	-	2	-	-	-	-	2
	24	-	1	-	-	-	-	-	1
	25	-	1	-	-	-	-	-	1
	30	1	1	-	-	-	-	-	2
	31	-	1	-	-	-	-	-	1
M.D.	61	-	-	-	-	-	1	-	1
	84	-	-	1	-	-	-	-	1
	87	-	-	3	1	1	-	-	5
	90	1	-	-	2	-	-	-	3
	92	1	2	-	1	1	-	-	5
TOTAL		4	12	8	7	2	6	1	40

TABLE XXI

LOCAL GOVERNMENT VS. PROVINCIAL SHARE OF COST PER ACRE

Local Government \ Prov. Share \$		Less than 10	10-20	21-30	31-40	41-50	Over 50	Total
County	3	-	-	1	-	-	-	1
	9	-	1	1	1	-	-	3
	10	-	-	-	-	1	-	1
	11	3	5	1	-	1	-	10
	12	-	-	1	-	-	-	1
	20	-	-	-	-	-	1	1
	22	-	-	1	-	-	-	1
	23	-	2	-	-	-	-	2
	25	-	1	-	-	-	-	1
	30	1	1	-	-	-	-	2
	31	1	-	-	-	-	-	1
M.D.	61	-	-	1	-	-	-	1
	84	-	-	1	-	-	-	1
	87	-	2	2	1	-	-	5
	90	1	1	1	-	-	-	3
	92	3	-	1	1	-	-	5
TOTAL		9	13	11	3	2	1	39

CONCLUSION AND IMPLICATIONS

It must be pointed out that this study is a "pilot" project in the area of flood control and drainage works evaluation. According to this study, there were approximately 39,000 acres benefiting from the works constructed during the period 1966 to 1971 in the Edmonton region. This represents about 0.3% of the land area in this region excluding land occupied by town and cities. This study points out the various kinds of information and relationships that can be derived by investigation of the files containing the information on the corresponding projects.

The real value of this study is derived from an extension of the existing data bank. That is, if one were to examine each individual project, one could determine its effectiveness in terms of increasing the quantity of agricultural production. Any increase in land values as a result of the project should also be noted. Further, a subset of this study could be the economic value (in terms of costs and returns) of drainage and flood control compared with those costs and returns from bringing treed areas into agricultural production. For example, the average cost per acre for the projects in this study is in the order of \$31, whereas the cost of clearing land and making it ready for crop production ranges from \$20 - \$50 per acre, depending on the density and size of the trees, if any.

In conclusion, it would be useful to use this model for an on-going analysis of flood control and drainage works. The practical use of the works should also be considered in order that the policies in this regard be most applicable to farmers' needs for such works.

HD 1683 C2 A14f 1972
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Agriculture. Resource
Flood control and
drainage study :

